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Project: Power Bill: Residential Rates

Company: Alabama Power

Website: https://www.alabamapower.com/content/dam/alabama-power/pdfs-docs/Rates/FD.pdf

Objectives:

(1.) Calculate the June through September power bill of the residents of Alabama within each range of specific water usage manually using Arithmetic method.

(2.) Write a piecewise function of the resident rates.

(3.) Recalculate the same power bill of resident of Alabama within each range of specific usage algebraically using the piecewise function method.

Information:

Monthly Rate

Base Charge: $14.50 per customer; plus

Charge for Energy:

Billing Months June-September

12.4384¢ per kWh for the first 1000 kWh, plus

12.6913¢ per kWh for all over 1000 kWh

Conversions (From cents to dollars):

$$12.4384¢ = \frac{\$12.4384}{100} = \$0.124384$$

$$12.6913¢ = \frac{\$12.6913}{100} = \$0.126913$$

Arithmetic Method:

(1.) 0 kWh

(2.) 700 kWh

(3.) 1500 kWh

(1.) 0 kWh

$cost = \$14.50$

(2.) 700 kWh

$cost = 14.50 + 0.124384(700)$

$cost = \$101.5688$

$cost \ \cong \$101.57$

(3.) 1500 kWh

$cost = 14.50 + 0.124384(1000) + 0.126913(1500 - 1000)$

$cost = 14.50 + 0.124384(1000) + 0.126913(500)$

$cost = \$202.3405$

$cost \cong \$202.34$

Piecewise Function

Let us define variables

$p = power\ consumed\ in\ kWh$

$c(p) = cost\ of\ power\ consumed\ in$ \$

$$first\ piece : 0 \le p \le 1000$$

$$c(p) = 14.50 + 0.124384p$$

$$c(p) = 0.124384p + 14.50$$

$$first\ piece : 0 \le p \le 1000$$

$$second\ piece : p > 1000$$

$$c(p) = 14.50 + 0.124384(1000) + 0.126913(p - 1000)$$

$$c(p) = 14.50 + 124.384 + 0.126913p - 126.913$$

$$c(p) = 0.126913p + 11.971$$

$$c(p) = \begin{cases} 0.124384p + 14.50; & 0 \le p \le 1000 \\ 0.126913p + 11.971; & p > 1000 \end{cases}$$

Piecewise Function Method

Let us test this Piecewise Function with the three values we used for the Arithmetic Method.

(1.) 0 kWh

This falls in the first piece.

$c(p) = 0.124384p + 14.50$

$c(0) = 0.124384(0) + 14.50$

$c(0) = 0 + 14.50$

$c(0) = \$14.50$

(2.) 700 kWh

This falls in the first piece.

$c(p) = 0.124384p + 14.50$

$c(700) = 0.124384(700) + 14.50$

$c(700) = 87.0688 + 14.50$

$c(700) = \$101.5688$

$c(700) \cong \$101.57$

(3.) 1500 kWh

This falls in the second piece.

$c(p) = 0.126913p + 11.971$

$c(1500) = 0.126913(1500) + 11.971$

$c(1500) = 190.3695 + 11.971$

$c(1500) = \$202.3405$

$c(1500) \cong \$202.34$

References (MLA citation):

Chukwuemeka, Samuel. “Where Is the Light Bill? It Is a Piecewise Function!” *Where Is the Light Bill? It Is a Piecewise Function!*, conferencepresentations.appspot.com/Projects/PreCalculus/PiecewiseFunctions/PowerBill.html. Accessed 24 Oct. 2024.

Rates FD Family Dwelling - Alabama Power, www.alabamapower.com/content/dam/alabama-power/pdfs-docs/Rates/FD.pdf. Accessed 24 Oct. 2024.